



MTBE

Fact Sheet #3

Use And Distribution Of MTBE And Ethanol

Background

Methyl tertiary-butyl ether (MTBE) and ethanol are the most common oxygenates used to meet the requirements for the U.S. EPA's Reformulated Gasoline (RFG) and Oxygenated Fuel (Oxyfuel) Programs. Both additives have been used in gasoline in the United States since 1979. MTBE was originally added as an octane-enhancing replacement for lead. Ethanol was originally introduced to make gasohol (*i.e.*, 10-percent ethanol in gasoline) as part of a program to reduce reliance on oil imports.

Summary Of Two U.S. EPA Clean Air Programs

The Oxyfuel and RFG Programs were initiated by the U.S. EPA in 1992 and 1995, respectively, to meet requirements of the 1990 Clean Air Act Amendments. The Oxyfuel Program requires the use of gasoline with 2.7-percent oxygen (by weight) in areas with high levels of carbon monoxide during the fall and winter. When MTBE is used to meet this requirement, it is used at a concentration of 15 percent (by volume) in gasoline. Because ethanol

has a higher oxygen content, it can meet this requirement with a concentration of 7.3 percent (by volume). The RFG Program requires 2.0-percent oxygen (by weight) throughout the year in the most polluted metropolitan areas. MTBE meets this level with an 11-percent (by volume) concentration, and ethanol can be used with a 5.4-percent (by volume) concentration.

Extent Of MTBE And Ethanol Use In The United States

Approximately 30 percent of all gasoline in the United States contains fuel oxygenates for compliance with RFG requirements. An additional 4 percent is used for compliance with Oxyfuel requirements. MTBE, which is the most common fuel oxygenate, is used in more than 80 percent of oxygenated fuels. Since 1993, MTBE has been the second most produced organic chemical manufactured in the United States. Ethanol, which is the second most common fuel oxygenate, is used in about 15 percent of the oxygenated fuels. Other oxygenates, which constitute the remaining 5 percent of the market, include tertiary amyl methyl ether (TAME), ethyl tertiary butyl ether

(ETBE), diisopropyl ether (DIPE), and tertiary butyl alcohol (TBA).

In addition to its use as a fuel oxygenate, MTBE is widely used for octane enhancement in mid and high-octane blended conventional gasoline, typically at concentrations ranging from 2 to 8 percent (by volume). It may also be found in regular grade gasoline at lower concentrations. The Oxygenated Fuels Association estimates that about 70 percent of all gasoline in the United States contains MTBE at varying concentrations. As a consequence of the wide-spread use of oxygenated fuels, underground storage tank regulators cannot assume that the gasoline in their region is free of MTBE just because the tank is located outside an RFG/Oxyfuel area.

Although it is difficult to predict the type of oxygenate used in a specific gasoline, there are general trends in their use. Ethanol is used primarily during the winter months to meet the requirements of the Oxyfuel Program. MTBE is used throughout the year, but its use increases in summer months as it replaces ethanol in regulated areas. Three major factors have influenced how these two fuel oxygenates are used in petroleum products.

Lower Vapor Pressure-MTBE

In addition to requiring that fuels burn cleaner, EPA requires areas with high levels of smog (including but not limited to RFG areas) to reduce the vapor pressure of gasoline in the summer months in order to decrease the volatilization of petroleum constituents at storage facilities and during fuel transfer. Because MTBE-blended gasoline has a lower vapor pressure than ethanol-

blended gasoline, MTBE is the preferred oxygenate in warm weather.

Convenience-MTBE

The cost of transportation and the convenience of use favors MTBE over ethanol. Because MTBE is more compatible with gasoline, it can be blended at the refinery and distributed with gasoline through pipelines. Ethanol, on the other hand, must be shipped separately from gasoline and added at the distribution terminal soon before use. If ethanol-blended gasoline is exposed to water or even water vapor (as in pipelines), ethanol will bring the water into solution and make the gasoline unusable. In addition, if ethanol-blended gasoline is stored for an extended period, the ethanol will begin to separate from the gasoline. As a result, ethanol is often manufactured close to the point of use or shipped by rail, increasing the cost of its use.

Tax Incentives-Ethanol

Market price and tax incentives play a major role in the use of MTBE and ethanol. Although the market price of MTBE is typically lower than that of ethanol, when the government subsidies are included, ethanol often costs less. The federal government provides a subsidy of \$0.54 per gallon of ethanol when it is blended in gasoline at concentrations between 5.4 and 10 percent (by volume). Furthermore, 12 states (Alaska, Connecticut, Hawaii, Iowa, Illinois, Kansas, Minnesota, Missouri, North Dakota, Nebraska, Ohio, and South Dakota) have additional incentives for ethanol production and use, making it even more competitive for these locations. Specific price information for MTBE and ethanol, including the effect

of federal tax subsidies, is provided in Exhibit I.

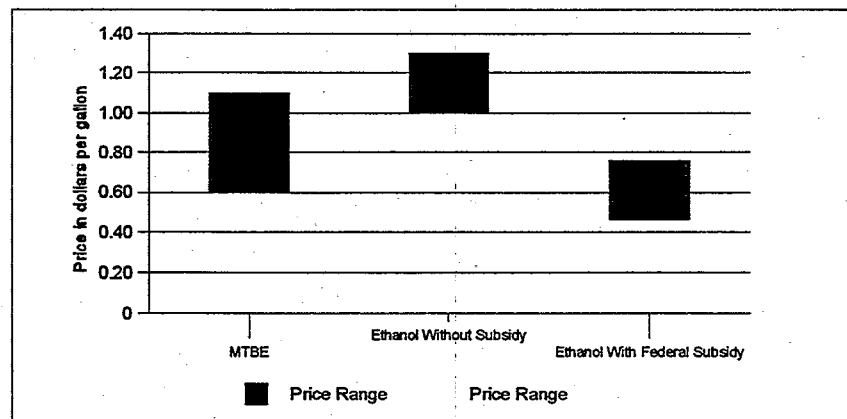
Additional Distribution Factor

Areas not required to use RFG/Oxyfuel may still receive these fuels on occasion if they are near RFG/Oxyfuel areas because of the complexity and imperfections of gasoline distribution systems. This situation, called "spillover," is most likely to occur when there is a shortage of non-oxygenated fuel and a surplus of oxygenated fuel. The petroleum industry tries to avoid this situation because RFG/Oxyfuel is more expensive to produce than conventional fuel. There are no accurate measurements of how often this situation occurs, but it probably accounts for less than 10 percent of total RFG/Oxyfuel sales.

Conclusion

MTBE is preferred by the petroleum refinery industry over ethanol for octane enhancement and RFG (2.0 percent oxygen, all year) because it is less expensive, is easier to use, and creates a gasoline with a lower vapor pressure. Although MTBE is also used in winter months, ethanol is commonly used in Oxyfuel (2.7-percent oxygen in the fall/winter months) because government subsidies make it price competitive and because gasoline volatility is not a major concern in cold weather. Although these trends in the use and distribution of oxygenated fuels are useful in helping to determine what type of additive to expect in a region, they are not predictive. MTBE may be found in new or old releases in virtually all areas of the United States.

Exhibit I. Price Ranges For MTBE And Ethanol¹



¹ January 1995 through October 1997.

